A.D. 1826 . . . . . N° 5327.

SPECIFICATION

OF

JOSIAS CHRISTOPHER GAMBLE.

APPARATUS FOR THE CONCENTRATION AND CRYSTALLIZATION OF ALUMINOUS AND OTHER SOLUTIONS.

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Apparatus for the Concentration and Crystallization of Aluminous and other Solutions.

GAMBLE'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, JOSIAS CHRISTOPHER GAMBLE, of Liffeybank, in the County of Dublin, Chemist, do send greeting.

WHEREAS His present most Excellent Majesty King George the Fourth hath, by Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Eleventh day of February, and in the year of our Lord One thousand eight hundred and twenty-six, and in the seventh year of His reign, did give and grant unto me, the said Josias Christopher Gamble, my executors, administrators, and assigns, His especial licence, full power, sole privilege and authority, that I, the said Josias Christopher Gamble, my executors, administrators, and assigns, during the term of fourteen years therein expressed, should and lawfully might make, use, exercise, and vend, within that part of the said United Kingdom of Great Britain and Ireland called England, His Dominion of Wales, and Town of Berwick upon Tweed, and also in all His said Majesty's Colonies and Plantations abroad, my Invention of "CERTAIN APPARATUS FOR THE CONCENTRATION AND CRYSTALLIZATION OF ALUMINOUS AND OTHER SALINE AND CRYSTALIZABLE SOLUTIONS, PART OF WHICH APPARATUS MAY BE APPLIED TO THE GENERAL PURPOSES OF EVAPORATION, DISTILLATION, INSPISSATION, AND DESICCATION, AND ESPECIALLY TO THE GENERATION OF STEAM;" in which Letters Patent there is contained a proviso obliging me, the said Josias Christopher Gamble, under my hand and seal, to cause a particular description of my said Invention, and in what manner

the same is to be performed, to be enrolled in His Majesty's High Court of Chancery within four calendar months next and immediately after the date of the said recited Letters Patent, as in and by the same, relation being thereunto had, may more fully and at large appear.

NOW KNOW YE, that, in compliance with the said proviso, I do hereby declare that the nature of my said Invention, and the manner in which the same is performed, is particularly described in manner following, and by the Drawings hereunto annexed, viz^{t}:—

The apparatus I employ for the purposes of evaporation, distillation, inspissation, and desiccation is represented in the accompanying Drawing by Fig. 1st. A, the boiler, consisting of two metallic vessels placed the one within the other. The flanches B, B, at top are formed to correspond, and are made air-tight by screws and cement in the usual way. The inner is seperated from the outer vessel by a space of two or three inches at bottom and sides. The outer vessel has a stroop at the bottom for drawing off the contents of the intermediate space. The boiler is set over a furnace in the usual way, which it is unnecessary here to describe. C is a curved pipe, from one to two inches in diameter more or less, according to the dimensions of the apparatus; the curve rises about eighteen inches, and its legs stand distant from each other about two feet. D, an air pipe proceeding from the most elevated part of the curved pipe, about one inch in diameter, provided with a stop-cock at E, and rising as high as the reservoir F. One leg of the curved pipe is attached at B to the flanch of the inner compartment of the vessel A. The other leg is attached to the side of the reservoir F; and thus a constant communication is maintained between the chamber of vessel A and the reservoir F. I shall in future denominate the space between the outer and inner compartments of vessel A, the chamber; the fluid it contains, the medial fluid; and the liquid to be operated on, the boiling liquid. In using this apparatus, I pour into the reservoir F any liquid the boiling point of which is thirty-five degrees or more higher than the liquid to be boiled. As soon as said liquid rises as high as the dotted line G, H, it passes through the curved tube, fills the chamber between the two compartments of the boiler A, and expels the air therefrom through the air pipe D. As soon as the chamber is filled, and the medial liquid remains stationary at the line G, H, that is, above the level of the curved pipe, the interior of the vessel A may be filled with the boiling liquid, and the fire lighted in the furnace. As soon as the medial liquid is raised about thirty degrees higher than the boiling point of the boiling liquid, the latter will commence boiling, while the medial fluid will not itself boil. I have uniformly remarked the important fact that any fluid medium forming

a stratum of two or three inches in diameter, as represented in the above apparatus, cannot have its temperature raised higher than from thirty to thirty-two degrees higher than the liquid in the interior boiler. In other words, I find the conducting power of the medial liquid, the inner vessel, and the boiling fluid so great, that the heat is expended in evaporating the boiling liquid as fast as it is communicated by the fire to the medial fluid. To form a distillatory apparatus, the interior compartment of vessel A may be constructed with a dome and eduction pipe, as represented by the dotted lines in Fig. 1st, or it may take any other form required, the species of metal being always adapted to the objects in view; one reservoir will suffice, or any number of boilers, when communicating by a main pipe with their curved tubes. But its capacity must at least equal one-eighth the capacity of all the chambers of said boilers, in order to leave room for the expansion of the medial fluid when heated, though I prefer the above form of apparatus for the purpose of evaporation, distillation, &c. I give it various modifications as circumstances may require. I sometimes give it the form of a flat parallelogram, A, B, Fig. 2d. In this form I make it of hammered iron or copper. The chamber *c*, *c*, is two or three inches in depth, and has its top and bottom strengthened by strong rivets, as represented in the Figure. The boiling compartment D, D, is from eight to twelve inches in depth. The curved pipe is attached to the most elevated corner of the upper compartment of the chamber, and resembles in all other respects, as well as does the reservoir, the curved pipe and reservoir of Fig. 1st. The apparatus I prefer for generating steam is formed of three cylindrical vessels open at one end, and closed and semi-globular at the other, as represented by Fig. 3d. The middle vessel B, B, is introduced into the outmost vessel A, A, and retained in its central position by means of a small iron roller, as is seen by the end view, Fig. 4th. At the open end they are closed by a circular rim with double flanches D, D, secured with screws and cement in the usual way. The outmost and middle vessels being firmly secured, the inmost vessel E, E, is introduced into the middle vessel B, B, and retained in its position by a roller similar to that before mentioned. The inmost vessel has a rim F, F, projecting three inches all round beyond its circumference; this rim is fitted and joined to the middle cylinder, and by its projection ajusts the dimensions of the chamber G, G. The curved pipe of communication between the chamber G and the reservoir is attached to the middle cylinder at F. The middle and inmost cylinders must extend six inches beyond the outmost, to leave space for their junction as well as the junction of the curved pipe with the chamber. A brick arch is constructed within the inmost cylinder springing from a little below its centre, and

extending to within a foot of the farther end. The fire is placed in front of and below this arch. The flame passes below the arch till it reaches the lower end of the cylinder; it then rises and returns above the arch, and enters the chimney. K, L, a pipe to clear off any sediment that may fall from the water to the bottom of the outer cylinder. M, a similar pipe for cleaning the top of the middle cylinder. The outmost vessel, though called a cylinder, is not strictly so. It is made smaller at its semi-globular end, in order to receive a number of stout cylindrical hoops like those used in shoeing strong cart wheels. These are driven firmly on the cylinder, and add greatly to its power of resisting pressure. At the circular end of the boiler may be placed the steam and feeding pipes as at N, O. The advantages of this apparatus I conceive to be these:—First, the form of the outward cylinder, and the strong hoops of malleable iron by which it is surrounded, give it great power of resisting the force of high pressure steam. Second, the lengthened circuit given to the flame by means of the returning flue greatly œconomizes heat. Third, the medial fluid being capable of heating the water in the boiler within thirty degrees of its own temperature, gives us the command of very high pressure steam. If fixed oil, for instance, were the medial fluid, the water in the boiler might be safely raised to four hundred degrees of temperature, which would put under our command a power not hitherto successfully employed by the steam engine. Fourth, with this apparatus we can work in perfect security, and dispence with the use of valves. Let the outer cylinder be made of sufficient strength to resist the force of steam raised to the temperature of the boiling point of the medial fluid, and it is evident an explosion can never happen, because the boiling water, receiving it heat from the medium, never can become hotter than that medium. And as the mediums, not being confined by pressure, can never be raised above its boiling point, so the boiling water can never exceed, or even reach, that boiling point. Thus, notwithstanding the vastly encreasing force of high pressure steam, it will be always in our power, by means of the strong hoops of malleable iron above referred to, to give to the outer boiler a power of resistance greater than the force of steam applied to it. The middle cylinder, from its form and position, will always be superior to any force it can have to bear. When the medial fluid consists of animal or vegetable oil, it will be advisable to confine its temperature considerably below its boiling point, say to about four hundred degrees of Farnh^{t}, to guard against its decomposition. For the same reason, the middle cylinder should be kept completely covered with boiling water. Should the medial fluid at any time boil into the reservoir, it is an indication of the engine rising too high a temperature, and, consequently, of the excessive force of the

steam. I sometimes construct boilers of an outer and an inner, and dispence with the middle cylinder and the medial fluid. The flame is made to circulate by means of the brick arch; the junction at the mouth is formed in the same manner as the outer and middle cylinders of Fig. 3d, and the outside vessel is hooped round in a similar way. But, as the heat is not applied to the boiling liquid by means of a fluid medium, the customary safety valves are thereby rendered necessary. The curved tube in all the Figures represents the form I prefer for connecting the chamber with the reservoir. But a tube answering the same purpose might proceed from the bottom or side of the chamber, and connect itself with the reservoir. In this case it would be necessary to give the tube an inclination downwards to prevent the hot fluid from the chamber passing into the reservoir, an event that never should occur. It must also have an air pipe at the most elevated part of the chamber, see Fig. 6. A, one form of communicating tube between the chamber and reservoir; B, another form; C, the air pipe. I do not claim as my Invention the doubled vessels with their chambers, Figs 1st, 2d, and 6th, such vessels having been used for high pressure steam, and various other purposes. But I do claim the Invention of the communicating tube and reservoir, by which such vessels can be more advantageously applied than hitherto to useful practice. Neither do I claim the use of any particular medial liquid for low heats, as the distillation of either or alcohol, the inspissation of extracts or drying of powders. I recommend water, or a satured solution of common salt. When higher heat is required, many other salts will be found answerable. But for boiling any liquid whose boiling point does not exceed two hundred and twenty-five degrees, I prefer a strong solution of muriate of lime, the boiling point of which may be carried from two hundred and fifty to three hundred, according to its density. For higher heats, as the boiling of sugar, or for high pressure steam, not exceeding thirty pounds to the square inch, I would recommend essential oils, especially oil of coal tar, on account of its great cheapness. Where still higher heats are requisite, the fixed animal and vegetable oils must be employed. In evaporating alum and many saline solutions, it will be requisite to line the boiler with lead, or such metal or substance as will resist the action of the boiling liquid. In this case it will also be requisite to have a much greater difference between the boiling point of the medial fluid and that of the boiling liquid. From fifty to sixty degrees of difference I found necessary. The vessel I employ for crystallization of alum and other saline and crystalline substances, Fig. 7th. A, B, a vessel of cast iron or other suitable metal, wider at the mouth than the bottom; said vessel may be fixed on or below the ground on a solid foundation, from which foundation it must be separated about four inches by three or more

pillars. C, C, a brick wall surrounding the vessel, and leaving a space all round its side to admit the circulation of steam; D, a steam pipe passing from a steam boiler through the brick wall, and to the centre of the bottom of the vessel; E, a staff resting on the centre of the bottom of the vessel, and rising above it, having a ring on its upper end, and a large knob at its base. The staff is placed on the bottom of the vessel before the crystallizing liquid is poured in. When the crystalline mass is ready for withdrawing, a chain from a crane is attached to the ring of the staff, steam is admitted round the vessel for five or ten minutes more or less, according to its quantity, and when the upper part of the crystal in contact with the metallic vessel is observed in a slight degree to liquify, the crane is turned, and the entire mass of crystals is elevated and removed to a proper place for breaking up the crystals, and receiving the mother waters. Where crystals less solid than alum are made, a broad plate instead of a knob may be attached to the staff. In large manufactories, where many crystallizing vessels are required, I place the crane in the centre, and form one or two circles of the crystallizing vessels around. I leave a breach in the circle, where the alum, &c. may be broken up, and a channel formed to convey the liquor to the reservoir. For alum and many other salts the crystallizing vessels and staff must be lined with lead, or some material as will resist the action of the liquor. The case surrounding the vessel may be made of wood or other suitable material, instead of the brick wall, and may be made fixed or moveable at pleasure. Reference to Fig. 3: H, H, the brick arch, causing the heat to circulate in the direction of the arrows before it passes to the chimney; K, Fig. 5, a cross section of the same arch.

In witness whereof, I, the said Josias Christopher Gamble have hereunto set my hand and seal, the Thirtyeth day of May, in the year of our Lord One thousand eight hundred and twenty-six.

JOS. C. (L.S.) GAMBLE.

Signed, sealed, and delivered by Josias Christopher Gamble, in the presence of

BABTIST GAMBLE.
FRS. M^{c}CORMICK.

Babtist Gamble, of Liffy Bank, in the County of Dublin, Gent^{n}, aged twenty years and upwards, maketh oath and saith, that he was present, together with Francis M^{c}Cormick, of Liffy Street, in the City of Dublin, Gent., and did see Josias Christopher Gamble, of Liffy Bank aforesaid, Chemist, sign, seal, and as his act and deed, in due form of law, deliver the Deed Poll or Specification

FIG. 1.

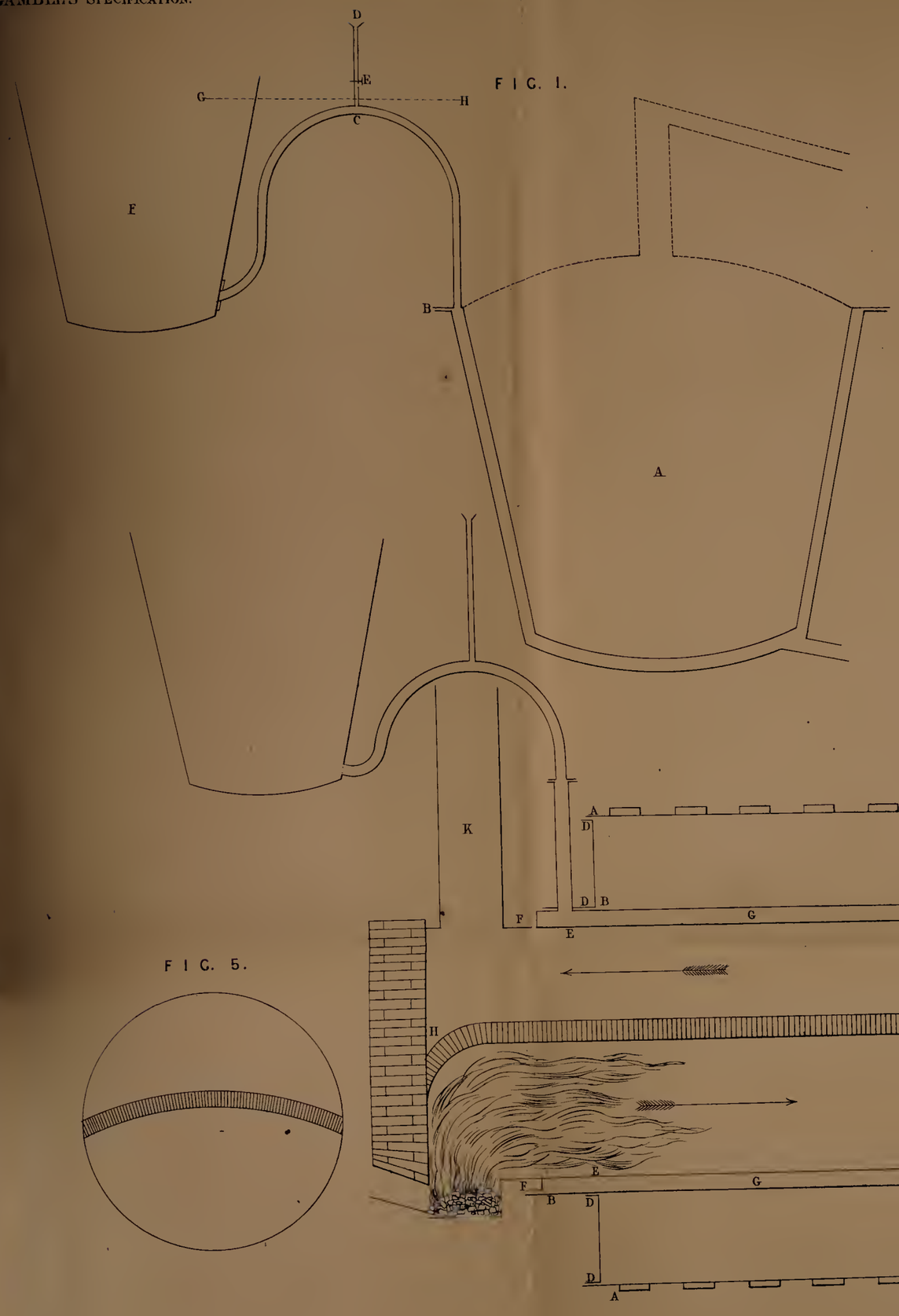


FIG. 2.

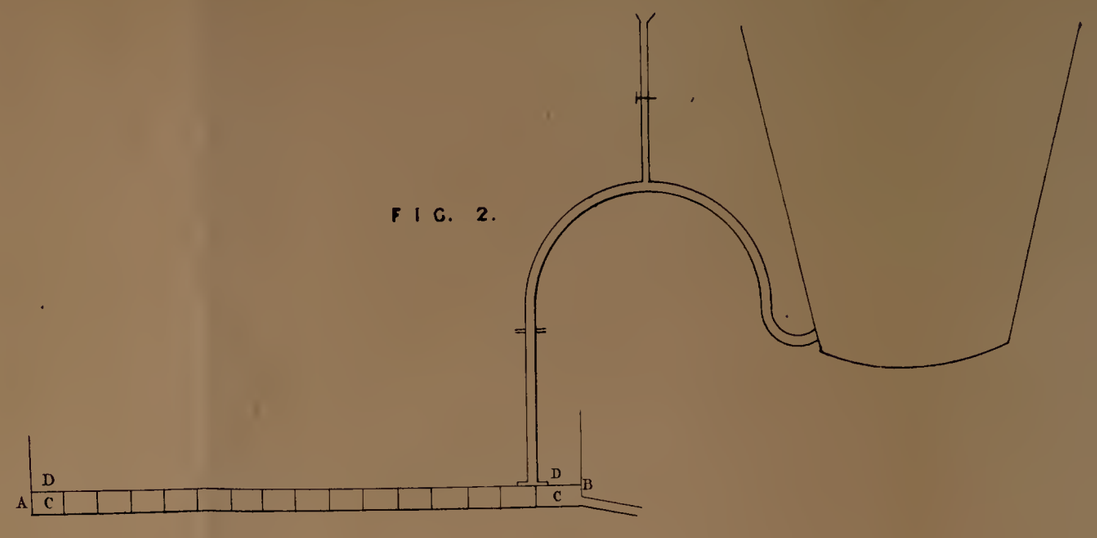


FIG. 3.

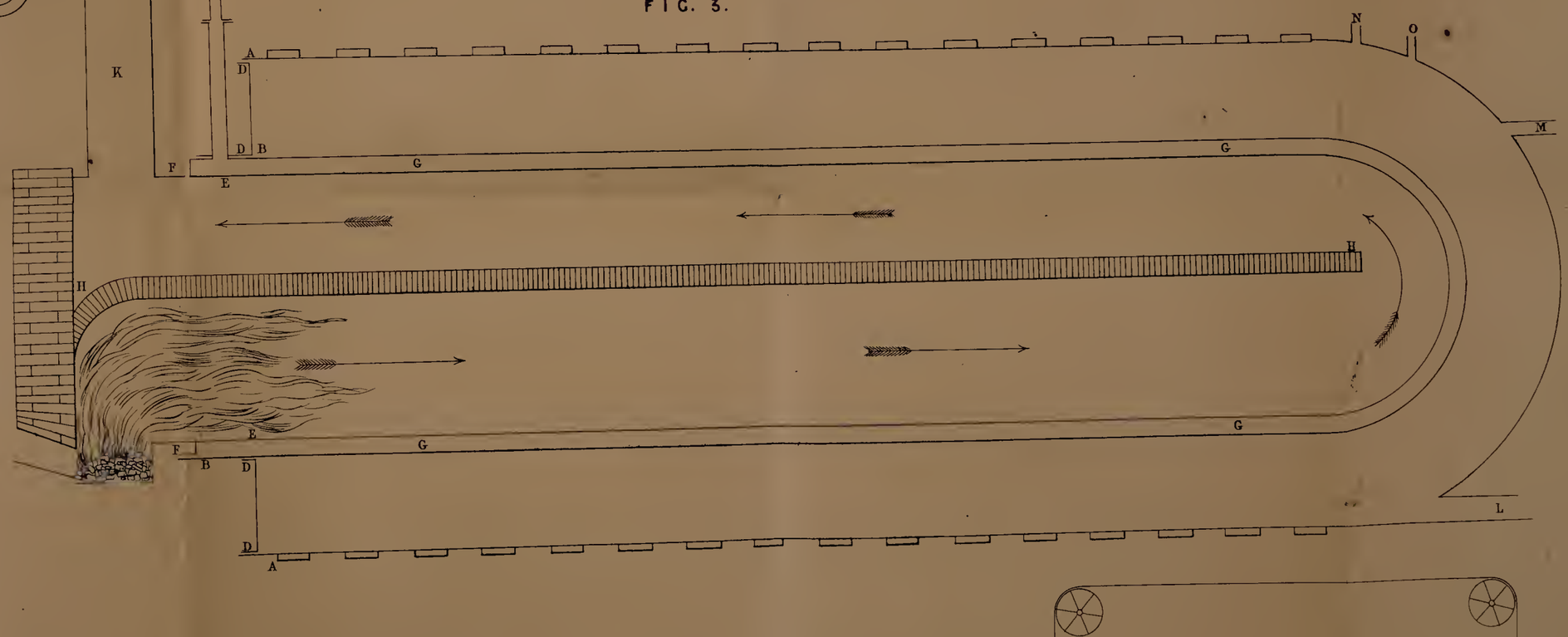


FIG. 5.

FIG. 4.

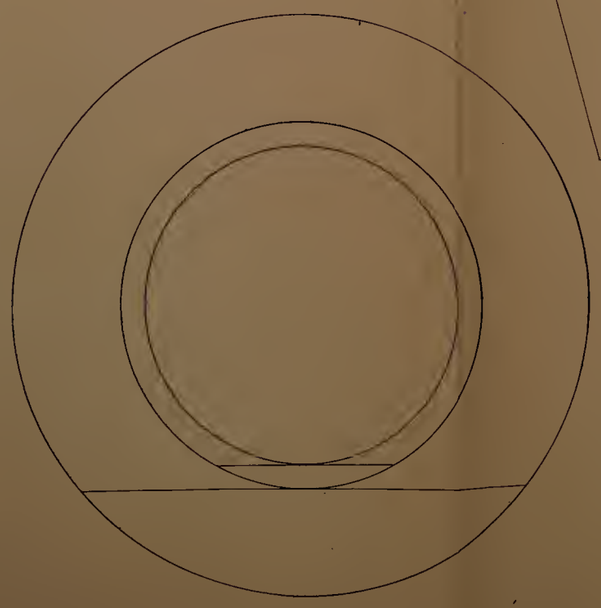


FIG. 6.

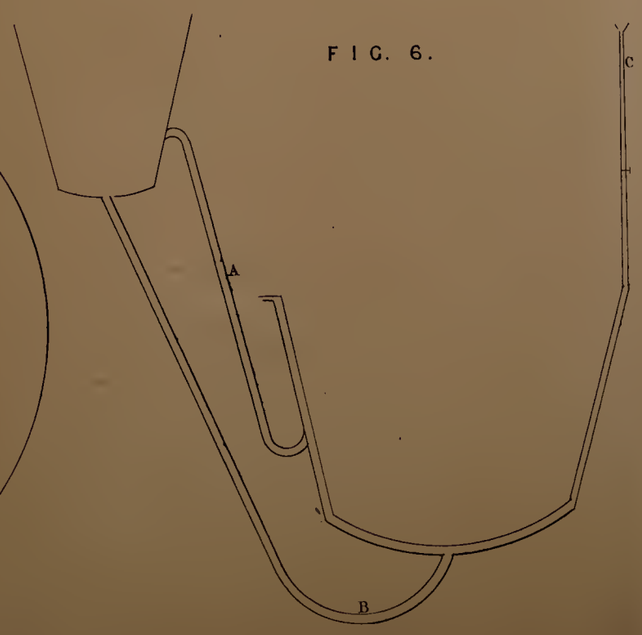
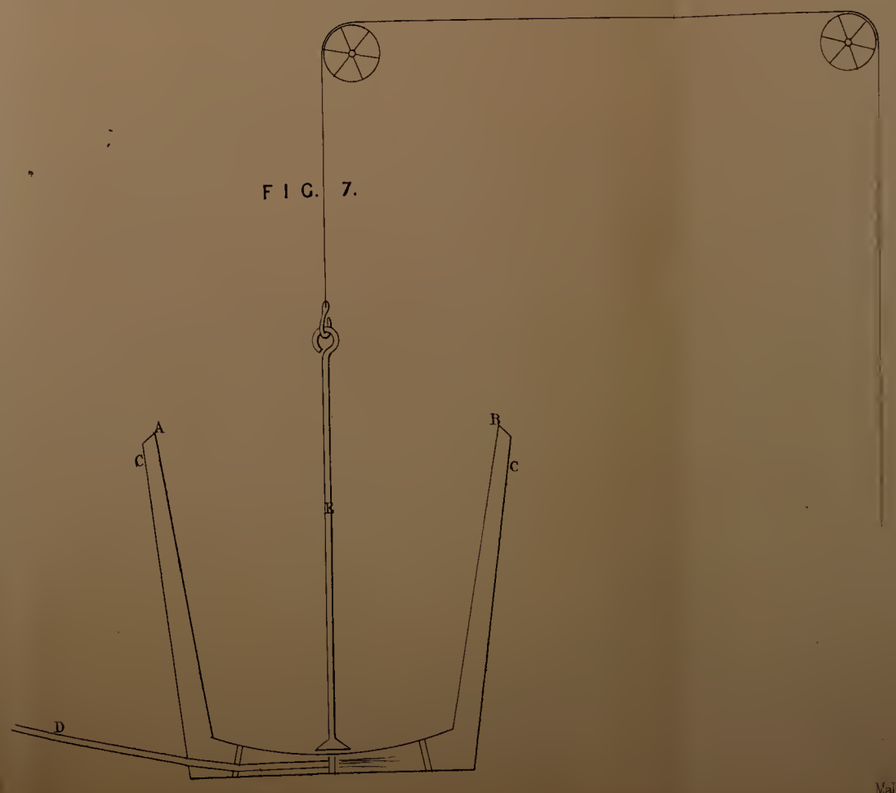


FIG. 7.



The enrolled drawing is not colored.

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Printers to the Queen's most Excellent Majesty 1854.

Malby & Sons, Lith

hereunto annexed; and saith that the name or character Jos. C. Gamble, thereto set and subscribed as the party executing the same; is of the proper hand writing of the said Josias Christopher Gamble; and that the names or characters Babtist Gamble and Francis M^{c}Cormick, thereto also set and subscribed as witnesses to the execution thereof, by the said Josias Christopher Gamble, are of the respective proper hands writing of the said Francis M^{c}Cormick and this deponent Babtist Gamble.

Sworn before me at my office, Inns Quay, this 30th May, 1826, Henry Fude, Clerke & Examiner to Rod^{k} Connor, Esq^{r}, Master in Chancery. See 6° Geo. IV. cap. 30, Sect. XIX.

Inrolled the Eighth day of June, in the year above written.

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Printers to the Queen's most Excellent Majesty. 1854.